Semester	**:**	**III**		
Course No.	**:**	**PHY-231**	**Credit Hrs.**	**: 3(2+1)**
Course Title	**:**	**Engineering Physics**		

SYLLABUS

Objectives : (i) To make the students acquainted with applications of Physics in engineering and different physical processes in Agricultural Engineering.

(ii) To be skilful in the study of the Magnetism, Quantum Mechanics, Spectroscopy, Solid state Physics, Semiconductors, Superconductivity, LASERS and MASERS, Holography and Optical fibre with emphasis to learn advancements in quantum computing, sensors, resource management and environmental sustainability, that will supportive for learning advanced digital techniques, which are valuable for cutting-edge Agriculture.

THEORY

Magnetism: Dia-, para- and ferro-magnetism- classification; Langevin theory of dia- and para-magnetism, adiabatic demagnetization, Weiss molecular field theory; **Introduction to Quantum Mechanics**: wave particles duality, de Broglie concept uncertainty principle, time dependent and time independent Schrodinger equation. **Spectroscopy**: Qualitative explanation of Zeeman effect, Stark effect and Paschen back effect, Raman spectroscopy; **Solid state Physics**: statement of Bloch function, bands in solids, effective mass, distinction between metals, insulators and semi-conductors. **Semiconductors**: Intrinsic and extrinsic semi-conductors, law of mass action, determination of energy gap in semi-conductors, donors and acceptor levels; **Superconductivity**: super conductivity, critical magnetic field, Meissner effect, isotope effect, Type I and II superconductors, Josephsons effect, DC and AC squids, introduction to high Tc superconductors. **LASERS and MASERS**: Spontaneous and stimulated emission, Einstein A and B coefficients, population inversion, He, Ne and Ruby lasers, Ammonia and Ruby masers; **Holography and optical fiber**: optical fiber- physical structure, basic theory, type of modes, characteristics of optical fiber and applications; **Illumination:** laws of illumination, luminous flux, luminous intensity, candle power, brightness.

PRACTICAL

To verify law of transverse vibrations along a string using electrical tuning fork; To determine e/m of electron using magnetron valve method; Determine dielectric constant of material using De-Sauty's bridge; Study the variation of magnetic field with distance along the axis of a current carrying circular coil and to determine the radius of the coil; Determine the energy band gap in a semi-conductor using a p-n junction diode; Study the LCR circuit; Find the wave length of light by using prism and spectrometer; Determine the low resistance using Carey Foster bridge without calibrating the bridge wire.

TEACHING SCHEDULE

THEORY [PHY-231]

Lecture No.	Topic	Sub-topics/ Key Points	Weightage (%)
1 - 4	Magnetism	Introduction, Properties of magnetic materials, Classification of Magnetism, Dia-, para- and ferro-magnetism; Langevin theory of dia- and para-magnetism, adiabatic demagnetization, Weiss molecular field theory	10
5 - 8	Quantum Mechanics	Introduction to Quantum Mechanics: Wave particles duality, De-Broglie concept Uncertainty principle, Time-dependent and Time-independent Schrodinger equation.	10
9 - 12	Spectroscopy	Qualitative explanation of Zeeman effect, Stark effect and Paschen-Back effect, Raman spectroscopy and its applications.	15
13 - 16	Solid State Physics	Introduction to Bravais Lattice, Band structure of solids, Effective mass, Distinction between (ICAR) Classification of Solids on the basis of band structure-Metals, insulators and semi-conductors. Statement of Bloch function.	10
17 - 20	Semiconductors	Definition of Intrinsic and Extrinsic semi-conductors, Law of mass action, Determination of energy gap in semi-conductors, donors and acceptor levels.	15
21 - 24	Superconductors	Superconductivity, Critical magnetic field, Meissner effect, Isotope effect, Type I and II superconductors, Josephsons effect, DC and AC squids, Introduction to high Tc superconductors.	15
25 - 28	Lasers and Masers	LASERS and MASERS: Spontaneous and Stimulated emission, Einstein A and B coefficients, Population inversion, He-Ne and Ruby lasers, Ammonia and Ruby masers.	10
29 - 32	Holography, Optical Fiber and Illumination	Introduction and Principle of Holography, Recording of the Hologram, Reconstruction of the image. Applications of Holography. Optical Fibre – Physical Structure, Basic theory, Types of modes, Characteristics of optical fibre and applications; Laws of Illumination, Luminous flux, Luminous intensity, Candle power, Brightness.	15
		Total =	**100**

TEACHING SCHEDULE

PRACTICAL [PHY-231]

Exercise No.	Exercise Title
1 - 2	To verify law of transverse vibrations along a string using electrical tuning fork
3 - 4	To determine e/m of electron using magnetron valve method
5 - 6	To determine dielectric constant of material using De-Sauty's bridge
7 - 8	To study the variation of magnetic field with distance along the axis of a current carrying circular coil and to determine the radius of the coil
9	To estimate the energy band gap in a semiconductor using a p-n junction diode
10 - 11	To study the LCR circuit
12 - 13	To study the frequency response of the parallel resonance circuits
14 - 15	To determine the Wavelength of laser light using prism and spectrometer
16	To determine the low resistance using Carey Foster bridge without calibrating the bridge wire

Suggested Readings [PHY-231]:

1. Avadhanulu, M.N. 2013. An Introduction to Lasers Theory and Applications. S. Chand Publication.
2. Chattopadhyay, D. and Rakshit, P.C. 2011. Electricity and Magnetism. S. Chand Publication.
3. Ghatak, A.K. and Lokanathan, S. 2022. Quantum Mechanics, Theory and Application. Trinity Press.
4. Griffiths, D.J. and Schroeter. 2018. Introduction to Quantum Mechanics. Cambridge University Press.
5. Khandelwal, D.P. 1985. A Laboratory Manual of Physics. Vani Publications.
6. Kittel, C. 2005. Introduction to Solid State Physics. Wiley Eastern Pvt. Ltd.
7. Laud, B.B. 2011. Lasers and Non-linear Optics. New Age International Publishers.
8. Mani, H.S. and Mehta, G.K. 2022. Modern Physics. Affiliated East-West Press.
9. Omar, M.A. 2002. Elementary Solid-State Physics. Pearson.
10. Prakash, S. 2011. Optics. Pragati Prakashan, Meerut.
11. Saraf, B. and Khandelwal, D.P. 1982. Physics through Experiments. Vol. I & II. Vikas Publication, New Delhi.
12. Subramanyam, N., Lal, B. and Avadhanulu, M.N. 2012. A Textbook of Optics. S. Chand Publ.
13. White, H.E. 2019. Introduction to Atomic Spectra. Mc-Graw Hill Publication.
14. Worsnop, B.L. and Flint, H.C. 1951. Advanced Practical Physics. Littlehampton Book Services Ltd.
15. Mehta, V.K. 1980. Principles of Electronics, S. Chand Publication.